Public Report for Roche Pharmaceuticals ESA-100

Introduction:

During the past decade, the ROCHE, Nutley, NJ site has shifted its activities from heavy chemical / pharmaceutical production to primarily research and development. This shift has caused a significant change in the energy consumption profile of the site.

The installed steam generating capacity of approximately 500 kLb / hr is predominately provided by dual fueled (natural gas and No. 6 fuel oil) boilers that were installed from the mid-1950's through the late 1960's. A cogeneration facility (2 X SOLAR Taurus combustion turbines with duct-fired heat recovery steam generators) provides up to 100 kLb / hr of the total steam capacity and approximately 10.4 MW of electricity. Since the cogeneration plant is base-load operated, the majority of steam production is from the heat recovery steam generators.

Winter steam loads are primarily space heating with many of the R&D areas requiring 100% make-up air. Summer loads are a mix of HVAC for reheat, process and steam absorption chillers.

Over the past ten years, facility management has conducted an aggressive energy efficiency campaign in the areas of HVAC, lighting, metering & monitoring, and operational best practices.

Objective of ESA:

The objective of the Energy Savings Assessment, ESA, was to evaluate the steam generation, distribution, and end use at the facility and use selected findings to introduce the staff to the US Department of Energy Steam Tools Software Suite

Focus of Assessment:

The assessment focused, primarily, on the steam generation portion of the facility, particularly the boilers.

Approach for ESA
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This ESA was somewhat unique due to the inclusion of the combustion turbine cogeneration units. The plant configuration does not directly lend itself to modeling in the Steam System Assessment Tool. Various boiler-related issues were modeled independently to provide the savings estimates

General Observations of Potential Opportunities:

General

A number of constraints impact the operation of the boilers and heat recovery steam generators:

- Duct Burner firing temperature limitations – certain operating conditions (low ambient temperature and reduced combustion turbine load) cause the HRSG gas temperature to approach metallurgical limits of the tube materials. Remedies for this condition may include replacement of the first row of HRSG tubes with a material suitable for higher temperatures (Note: there are controls to limit the firing temperature of the duct burners.) The advantages of maximizing steam produced by the duct burner are:
    - Duct Burner efficiency is typically > 93%
    - Natural gas used in the cogeneration facility has a significant price advantage over natural gas used as boiler fuel.
- The fuel flow rate to the duct burner is limited by environmental permits to a maximum of 38 mmBtu/hr.
- Boilers Nos. 7 & 8, due to their age, combustion control systems, and strict air quality standards, are operating near the upper limit for NOx emissions, particularly during low-load periods. Studies are currently underway for a combustion control retro-fit to address these issues and to

provide for lower levels of excess air at low loads. While these efforts will have a positive effect on boiler efficiency, emissions control is the primary goal.

Opportunities

1. Install new, smaller boiler to offset steam generation by oversized, low-efficiency boiler

   Based on displacement of 20,000 lb/hr of steam generated by larger boilers at low load at an efficiency of 73.6% over a period of 5,100 hours annually with a fuel cost of $11.75 / mmBtu. The savings in fuel cost is approximately $262,000 annually (a reduction of 22,950 mmBtu).

   The installation would require the demolition of the retired-in-place No. 10 boiler as well as a modification to the facility's air permits. Air permit modifications can range from 12 to 18 months to accomplish.

2. Install economizer on No.8 boiler

   Based on 4,500 annual operating hours, installation of an economizer on the No. 8 boiler would yield an annual savings of approximately $65,000. Such a project would be dependant on the completion of combustion controls upgrade for NOx control as detailed above.

3. Increase Boiler FD Fan inlet temperature

   Routing the Forced Draft fan inlet to the upper level of the boiler room would increase the inlet temperature and therefore the efficiency. Annual savings of approximately $13,000 are possible.

   This modification is only feasible after NO_x control modifications are complete as increased inlet temperature would aggravate the production of thermal NO_x in the boiler, which is operating just under the upper permitted limit.

All opportunities fall into the classification of Medium Term Opportunities as defined below:

- Near term opportunities would include actions that could be taken as improvements in operating practices, maintenance of equipment or relatively low cost actions or equipment purchases.
- Medium term opportunities would require purchase of additional equipment and/or changes in the system such as addition of recuperative air pre-heaters and use of energy to substitute current practices of steam use etc. It would be necessary to carryout further engineering and return on investment analysis.
- Long term opportunities would require testing of new technology and confirmation of performance of these technologies under the plant operating conditions with economic justification to meet the corporate investment criteria.

The total percentage of natural gas saved (relative to total boiler fuel) is approximately 15.6% and can all be considered Medium Term.

Management Support and Comments:

The steam generation and distribution facilities at Roche are well maintained and operated, and are good examples of best energy management practices especially given the dramatic changes in mission and steam demand over the past decade.

Corporate management, at both the local and international level, is reported to be highly supportive of energy and environmental initiatives. This is borne out by the projects that have been completed over the past several years and the involvement of the energy management staff in future planning.

Case Study Potential

The US DOE staff has requested that facilities with significant, identified energy savings opportunities as well as facilities that demonstrate Best Practices in energy management be highlighted for possible inclusion in future Case Studies or White Papers.

The experiences at the ROCHE, Nutley, NJ facility in dealing with changing site missions / energy profiles, economic pressures, etc should be highlighted. There are many lessons learned here that can be shared across multiple industrial sectors.

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